

REMARKS/ARGUMENTS

Claim 1 is amended by combining with claim 4, so that polyoxyalkylene amine is restricted to polyoxypropylene diamine. Therefore, claims 1, 5-9, 12-15 are no longer anticipated by Reference B (BARBEE et al., US 6,071,988).

Claim 2 is canceled as the Examiner's suggestion. Claim 3 is canceled as the depended claim 1 is amended. Claim 4 is canceled as being combined into claim 1. Claim 5 is amended by deleting talc.

Claim 7 is amended by combining with claim 11, so that polyoxyalkylene amine is restricted to polyoxypropylene diamine.

Claim 8 is amended by deleting talc. Claim 10 is canceled as the depended claim 7 is amended. Claim 11 is canceled as being combined into claim 7.

Regarding the Examiner's objections/rejections, the applicant explain as follows:

1. Rejection as double patenting with Application No. 10/029,727

Application No. 10/029,727 dealt with only one-end amine intercalating to silicate surface. The other end was blocked, which remains "outside" of layered structure but bring in the polypropylene functionality. The present invention mentioned a diamine or difunctional incorporating sites for clay layers. Hence, high d-spacing (58Å, 92Å) can be observed. Both intercalations offered different "compatibility" for end-applications.

The modified clay obtained in Application No. 10/029,727 presents lower polarity and is compatible with resins such as PP, PE, PS, etc. Relatively, the modified clay obtained in the present invention presents higher polarity and is more compatible with resins such as epoxy, nylon, PET, etc.

2. Rejection as being anticipated by Reference A (Lan et al. US 6,225,394 B1) cited by the Examiner

The Examiner pointed out "The prior art of LAN discloses composition for nanocomposite comprising organically modified clay."

The nanocomposite composition of Reference A is formed by intercalating an onium ion and ethylene vinyl alcohol (EVOH) into a layered silicate material. Essentially, the onium ion and EVOH are both hydrophilic and the spacing of adjacent layers is increased only to 30Å.

The Examiner further pointed out “According to the specification, the ammonium compound can be propoxylated or ethoxylated or both (col. 9, lines 55-62).”

However, according to the description of Reference A, only the end-ligands R¹, R², R³ and R⁴ (not the backbone R) are particularly indicated to be propoxylated or ethoxylated. The same paragraph further indicates “Preferably, at least one of R¹, R², R³ and R⁴ is alkoxyLATED.” Differently, in Examples of the present invention, such positions are hydrogen, and specifically the backbone is polypropylene. In other words, the amine-groups are tethered at both ends of the backbone and affect the silicate interlayer spacing. Sequentially, the present invention can easily expand the spacing over to 50Å and even to 92Å.

3. Rejection as being anticipated by Reference B (Barbee et al. US 6,071,988) cited by the Examiner

The Examiner pointed out “The prior art of Barbee discloses process for making polyester nanocomposites, which comprises inorganic clay treated with at least one polyalkoxyLATED ammonium salt.” In Example 1 of Reference B, octadecyl methyl bis(polyoxyethylene[15]) ammonium chloride is provided for intercalating sodium montmorillonite. In Example 2, dilute aqueous hydrochloric acid is further provided for acidifying octadecyl bis(polyoxyethylene[5]) amine.

Even though Reference B expanded the organic ligands of general Formula I representative of organic cation salts to a relatively wide range, only polyoxyethylene amine is used in Examples thereof. Specifically, such compounds are hydrophilic and provide only one amino end for intercalating into the clay. Consequently, Reference B can exhibit basal spacing less than 50Å.

4. Characteristics of the present invention

The present invention discloses a composite formed by intercalating polypropylene diamine into layered silicate clay. Different from the

intercalating agents of the cited references, polypropylene (POP) diamine of the present invention is "hydrophobic", which significantly affects the intercalating manners. In general, the hydrophilic polyoxyethylene (POE) amine backbones tend to flatly adsorb onto silicate surfaces, due to the polar nature of the $-(CH_2CH_2O)_x-$ structure. On the other hand, the hydrophobic POP diamine associates with the silicate surfaces via the tethered quaternary amine salts, but not with backbone $-(CH_2CH(CH_3)O)_x-$. Therefore, two noncovalent forces, the ionic telechelic amine/clay association and the hydrophobic effect of POP backbone, influence the POP stretching and orientation in the confinement. Consequently, wide spaced silicate platelets are observed.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,



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Clean Version of Claims

WHAT IS CLAIMED IS:

1. A complex of clay and polyoxypropylene diamine, wherein said clay is layered and includes silicate, and said polyoxypropylene diamine is provided as an intercalating agent has molecular weight over 1,800.
5. The complex of claim 1, wherein said clay is selected from a group consisting of montmorillonite, kaolin, and mica.
6. The complex of claim 1, wherein said clay has a cation exchange capacity between 50-200 meq/100g.
7. A method for producing a complex of clay and polyoxypropylene diamine, wherein said clay is layered and includes silicate; said method is primarily to acidify said polyoxypropylene diamine with an inorganic acid, which is then mixed with said clay swelled with water previously; the mixture is then powerfully stirred at 60-80°C for cation exchanging to obtain said complex.
8. The method of claim 7, wherein said clay is selected from a group consisting of montmorillonite, kaolin, and mica.
9. The method of claim 7, wherein said clay has a cation exchange capacity between 50-200meq/100g.
12. The method of claim 7, wherein said polyoxyalkylene amine is added at least equal to cation exchange equivalence of said clay.
13. The method of claim 7, wherein said inorganic acid is selected from a group consisting of hydrochloric acid, sulfuric acid, phosphoric acid and nitric acid.
14. The method of claim 7, wherein said complex is applied as an oily surfactant.
15. The method of claim 7, wherein said complex is applied as an reinforcing agent of polymers.